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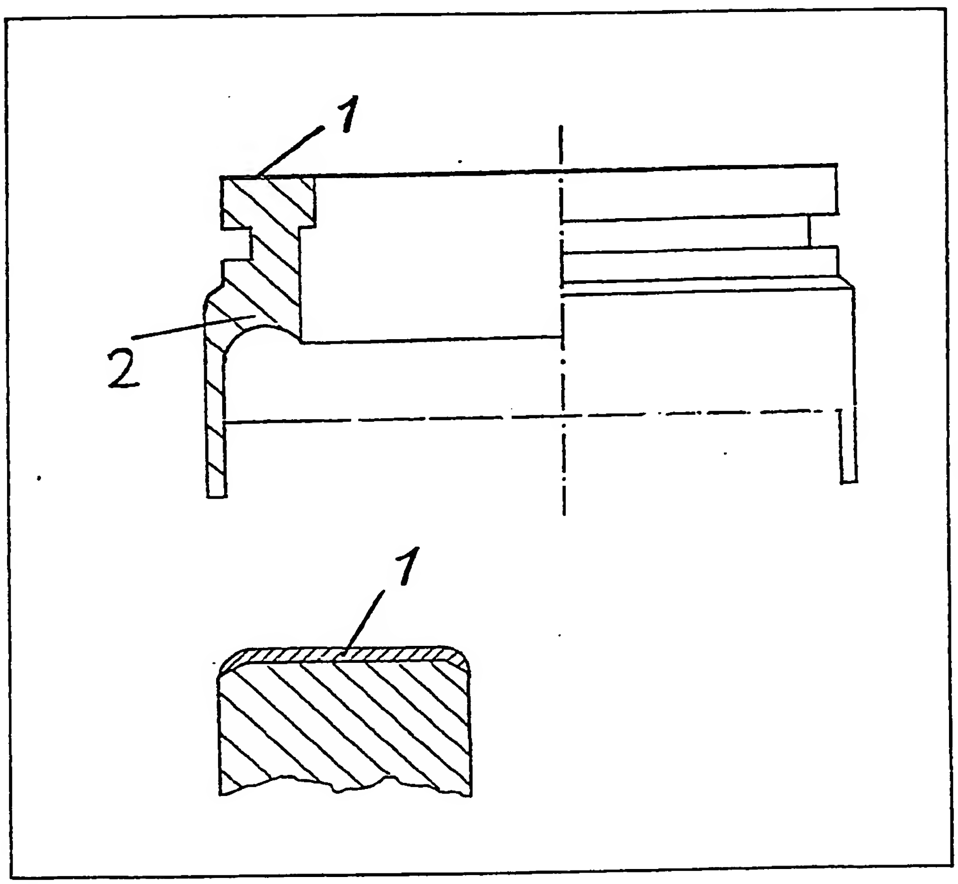
(54) **Plasma coating of sealing surfaces**

(57) A method for coating a sealing surface that rotates with respect to a countersurface, eg. sealing surfaces of pumps in petro-chemical and wood-processing industries comprises the combination of use of high energy plasmaspraying, the spraying mixture comprising 80-94 weight-% tungsten carbide and 6-20 weight-% cobalt nickel or iron and the grain size of the spraying mixture being 5-60 μm, and allowing the coating to cool after plasmaspraying without sintering it afterwards so that a certain porosity remains on the coating.



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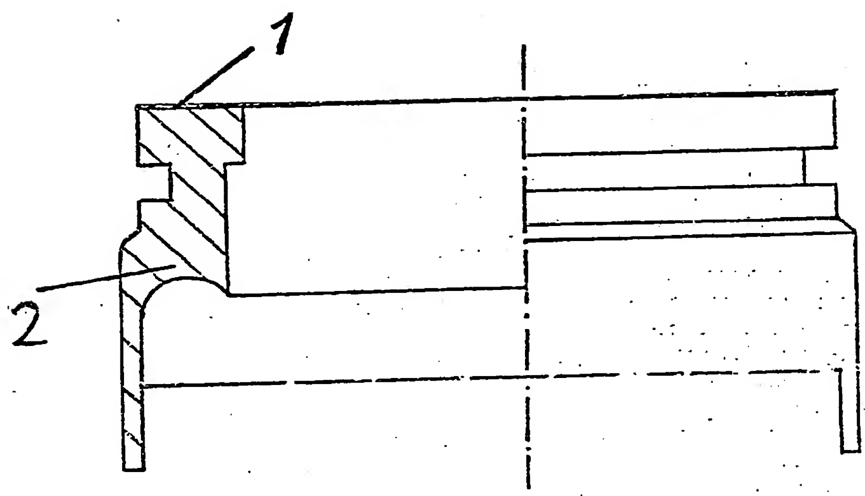
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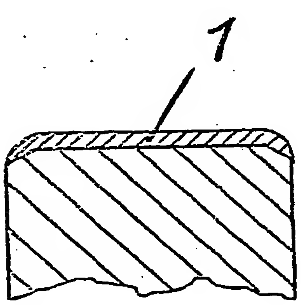
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SPECIFICATION

A method f r coating m chanical seals

This invention applies to a method for coating mechanical seals, to state it more specifically, a method for coating a sealing surface that rotates with respect to a countersurface, especially the sealing surfaces of pumps used in petrochemical and wood-processing industries.

Up to now known methods for producing the sliding surfaces of mechanical seals are, for example, welding with Stellite (Registered Trade Mark), plasmaspraying with a ceramic compound, and by mechanically fastening a hard metal ring to the contact surface. Stellite welded sliding rings generally function reliably but their service life is often very short. On the other hand ceramic coatings have the disadvantage of getting damaged easily. Quite often the damage occurs at installation or when the rotating object begins to move causing extra frictional heat to be applied to the sliding surface.

When using hard metal ring fastened mechanically to a contact surface, damage to the hard metal ring often occurs when the rotating object begins to move. This is due to a break in thermal conductivity between the hard metal ring and the body of the sliding ring, because a seal has to be used between th m. On the other hand the seal is also often damaged and thus causes leakage.

There have also been attempts made to coat the sliding surface of a mechanical seal by plasmaspraying. This is mentioned, for example, in the publication "Plasmatechnologie Grundlagen und Anwendung", Deutscher Verband für Schweisstechnik, 1970, pp. 148-151, as well as in the US-patent publications 3 642 519 and 3 936 295. A tungsten carbide-cobalt mixture, which is also used in the present invention, is mentioned as a coating material.

It must be noted however that the known methods have had difficulties in getting the coating to adhere well to the base and in attaining a sufficient internal strength and thermal conductivity for the coating. This is why methods other then plasmaspraying as described above, are still used in, for example, the petrochemical industry.

In connection with the present invention it has however been noted that with the right spraying technique, the right mixture, and the right grain size excellent results compared with conventional technology can be achieved. It is also important that the material is not sintered after the plasmaspraying as is suggested in the aforementioned American publications. If all of the porosity of the coatings on, for example, the seals used in the petrochemical industry's pumps, is removed by sintering, the film of the substanc b ing pump d that forms on the surface is broken and thus the coating wears quickly.

The purpose of the invention is to avoid the troublesom drawbacks in the prior art. In other words the purpose is to achieve a mechanically durable sliding surface that will not wear or damage easily.

The features of the invention are the following: high energy plasmaspraying is used; the spraying mixture used contains 80-94 weight-% tungsten carbide and 6-20 weight-% cobalt nickel or iron of grain size 5-60 μm; and after the plasmaspraying the coating is allowed to cool without sintering it afterwards so that a certain porosity remains in the coating.

The attached figure illustrates a cross-sectional drawing of a mechanical seal coated according to the invention, in which the coating is indicated by the number 1 and the sliding ring by the number 2.

In actual practice the coating is done by coating the contact surface, which is usually made of acid-proof steel, by plasmaspraying with high energy spraying values and by using spraying material that is a mixture of tungsten carbide and a metal from th iron group. The usual composition of the mixture is 80-94 % tungsten carbide and 6-20 % cobalt, nickel, or iron. The mixture's grain size is usually 5-60 micrometers. A coating thickness that is even less than 0.2 mm can be used.

Examples

To carry out practical experiments the sealing surfaces of a series of mechanical seals were coated by high energy plasmaspraying with a spraying mixture that was composed of tungsten carbide and cobalt in the ratio 83:17. The measured thickness of the coatings on the seals was 0.2 mm.

The seals prepared in the above manner were installed in an oil refinery's four benzene pumps (GA 17215-17218) at the beginning of January 1980. Up to that point stellite welded seals, which had lasted about 1-4 weeks effective rotating time, were used in the mentioned pumps. The constant changing of seals was quite a financial burden for the factory due to the frequent lay-days and also because personnel had to always be on the alert to change the seals.

Since no service interruption had come up by the beginning of February 1981 all of the aforementioned pumps were opened to check the conditions of the seals. At that time it was noted that all of the seals were in excellent condition and as a result there was no need even at that point to change them. By that time the effective rotating time of each pump had been over five months.

As the above reveals, the durability of seals produced according to the invention was already at that point twenty times greater than stellite welded seals. When it is decided at some time in the future that the testing is over and the seals are changed, the mentioned durability will obviously be even more than 20 times greater. In addition to the enormous improvement in durability, a seal that is produced according to the invention is also advantageous in that the thickness of the coating used is at the most 0.5 mm. but usually about 0.2 mm, in contrast to the API 610 standard. According to API 610 the thickness of a coating must be at least 0.76 mm which means that normally almost four times more coating material is used than when the coating is done according to the invention. In other words the improvement in

The drawing(s) originally filed was/were informal and the print here reproduced is taken from a later filed formal copy.

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